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U.S. Department
of Transportation

East Building, PHH-30
1200 New Jersey Avenue S.E.
Washington, D.C. 20590

**Pipeline and Hazardous
Materials Safety Administration**

DOT-SP 20396
(SECOND REVISION)

EXPIRATION DATE: 2023-01-31

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Hexagon Digital Wave LLC
Centennial, CO
2. PURPOSE AND LIMITATION:
 - a. This special permit authorizes the transportation in commerce of certain gases listed in paragraph 6 in certain composite overwrapped pressure vessels (COPV) listed in paragraph 7 when Modal Acoustic Emission (MAE) examination is used for requalification in lieu of the hydrostatic or proof pressure testing required in § 180.205 and the relevant special permits, as described in this special permit. This special permit provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein.
 - b. The safety analyses performed in the development of this special permit only considered the hazards and risks associated with the transportation in commerce.
 - c. No party status will be granted to this special permit.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR § 180.205(g) in that the MAE is performed in place of the hydrostatic test and internal visual inspection, as provided herein.

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5. BASIS: This special permit is based on the applications of Hexagon Digital Wave LLC dated May 2, 2019 and July 8, 2019 submitted in accordance with § 107.105 and the public proceeding thereon and additional information received on December 13, 2019.

6. HAZARDOUS MATERIALS (49 CFR 172.101):

Hazardous Materials Description			
Proper Shipping Name	Hazard Class/ Division	Identi- fication Number	Packing Group
Air, compressed (containing up to 39% by volume oxygen)	2.2	UN1002	N/A
Argon, compressed	2.2	UN1006	N/A
Bromotriflouromethane or Refrigerant Gas, R 13B1	2.2	UN1009	N/A
Carbon dioxide	2.2	UN1013	N/A
Chlorodiflourobromomethane or Refrigerant Gas, R12B1	2.2	UN1974	N/A
Compressed gas, n.o.s.	2.2	UN1956	N/A
Helium, compressed	2.2	UN1046	N/A
Heptaflouropropane or Refrigerant Gas R 227	2.2	UN3296	N/A
Hydrogen, compressed	2.1	UN1049	N/A
Methane, compressed or Natural gas, compressed (<i>with high methane content</i>)	2.1	UN1971	N/A
Neon, compressed	2.2	UN1065	N/A
Oxygen, compressed	2.2	UN1072	N/A
Nitrogen, compressed	2.2	UN1066	N/A

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Hazardous Materials Description			
Proper Shipping Name	Hazard Class/ Division	Identification Number	Packing Group
Nitrous oxide	2.2	UN1070	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING: Packagings prescribed are composite overwrapped pressure vessels (COPV) that were manufactured in accordance with UN/ISO 11119-2 & 11119-3, DOT-CFFC and FRP-1 standards, and COPVs manufactured under DOT-SP 11194, DOT-SP 10915, DOT-SP 10945, DOT-SP 14402, DOT-SP 14951, DOT-SP 15136, DOT-SP 13175, DOT-SP 13250, DOT-SP 14509, DOT-SP 20391, DOT-SP 16524, DOT-SP 20507, and DOT-SP 20418. These COPVs must be subjected to periodic inspection and testing (requalification) and marking as specified in §§ 180.205, 180.209, and 180.213 and as specified in each relevant special permit except that each COPV is examined by the Modal Acoustic Emission (MAE) method in lieu of hydraulic proof pressure testing and internal visual inspection. Each COPV must be requalified in accordance with the procedures specified in the requalification procedure described in this special permit and the application for this special permit on file with the Office of Hazardous Materials Safety Approvals and Permits Division (OHMSAPD).

b. Requalification: Each COPV must be requalified once every five (5) years by an approved facility that has a DOT RIN from the OHMSAPD for requalification of the COPVs listed in paragraph 7.a. using Modal Acoustic Emission (MAE) testing in lieu of hydrostatic testing and internal visual inspection in accordance with following:

(1) External Visual Examination: Each COPV must receive an external visual examination in accordance with CGA Pamphlet C-6.2 Standards for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders (COPVs) or ISO 11623 "Gas cylinders – Composite construction – Periodic inspection and testing". Cylinders (COPVs) that do not meet C-6.2 acceptance criteria must be condemned.

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(2) MAE Examination (Testing) procedure: MAE testing procedure and accept/reject criteria must be in accordance with the Modal acoustic emission (MAE) examination Specification for Requalification of Composite Overwrapped Pressure Vessels (Cylinders and tubes) posted on the Pipeline and Hazardous Materials Safety Administration website, <https://www.phmsa.dot.gov/technical-resources/hazmat-technical-resources/technical-reports>, and the additional procedure and supporting documents provided by the applicant on file with OHMSAPD. The supporting documents include "MAE Testing of Type IV Composite Tubes" dated August 28, 2015, and March 15, 2016 on file with OHMSAPD.

c. MARKING: Retest markings must be applied on a label securely affixed to the COPV and over coated with epoxy, near the original test date. The retest markings must include the retest date, requalifier RIN, and "MAE" as the requalification test procedure. The marking of the RIN number on the COPV certifies compliance with all terms and conditions of this special permit.

d. REPORT: A report must be generated for each COPV listing all COPVs that were examined. The MAE reports must be on file at the test site and made available to a DOT representative when requested. The MAE reports must include the following:

- (1) RIN.
- (2) MAE technician's name and certification level.
- (3) MAE equipment, model, and serial number.
- (4) COPV manufacture date, design type, serial number, special permit number, test pressure, and service pressure.
- (5) Test date.
- (6) MAE test pressure.
- (7) Decay rate B values.
- (8) The final value of each Allowance factors (F1, F2, M1, M2) to determine accept/reject of the COPV.

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(9) The value of event energies exceeding the fiber bundle failure criteria.

(10) The value of event energies exceeding the FRAE requirement.

(11) Background energy oscillation pressure.

(12) Visual inspection results (Pass/Fail).

(13) Acceptance/rejection results (Pass/Fail).

(14) Brief description for each condemned COPV.

e. PERSONNEL QUALIFICATION: Each person who performs retesting or who evaluates or certifies retest results must meet the following requirements:

(1) Project Manager is the senior manager of Hexagon Digital Wave LLC responsible for compliance with DOT regulations including this special permit. Additionally, the project manager must ensure that each operator and senior review technologist maintain the required certifications described herein.

(2) The personnel responsible for performing COPV retesting under this special permit shall be qualified to an appropriate Level (Level I, II, or III) in modal acoustic emission (MAE) testing in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A-1996 depending upon the assigned responsibility as described below:

(i) As a minimum, a Level II Operator must perform system startup, calibrate the system, and review and certify the test results when written acceptance and rejection criteria for COPVs has been provided by a Senior Review Technologist. Based upon the written criteria, the Level II Operator may authorize COPVs that pass the retest to be marked in accordance with paragraph 7.c. of this special permit. However, a person with Level I certification may perform a system startup, check calibration, and perform MAE under the direct guidance and supervision of a Senior Review

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Technologist or a Level II Operator, either of whom must be physically present at the test site to be able to observe examinations conducted under this special permit.

(3) Senior Review Technologist (SRT) is a person who provides written MAE procedure, supervisory training and examinations (Level I and II), technical guidance to operators, and reviews and verifies the retest results. The SRT must prepare and submit the reports required in paragraph 7.d. and annually verify that the MAE program is being operated in accordance with the requirements of this special permit. An SRT must have a thorough understanding of the DOT Regulations (49 CFR) pertaining to the requalification and reuse of DOT COPVs authorized under this special permit and ASNT Recommended Practice SNT-TC-1A and possess:

(i) A Level III certificate from ASNT in UE, with a documented experience for a minimum of 2 years of experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the Modal Acoustic Emission techniques;

(ii) A Professional Engineer (PE) License with a documented experience for a minimum of 2 years of experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the Modal Acoustic Emission techniques; or

(iii) A PhD degree in Engineering/Physics with documented evidence of experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines, using the modal acoustic emission technique or research/thesis work and authoring/co-authoring of technical papers published, in recognized technical journals, in the fields of modal acoustic emission testing methods.

The MAE technician must be capable of examining the waveforms (event by event), and the waveforms for each event must precisely correspond with the pressure and time data during the test.

The most recent copies of certification (e.g., ASNT Level III or PE license) must be available for inspection at each requalification facility.

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f. OPERATIONAL CONTROLS: Following operational controls apply to this special permit:

(1) No person may perform inspection and testing of COPVs subject to this special permit unless:

(i) That person is an employee of Hexagon Digital Wave LLC and has a current copy of this special permit at the location of such inspection and testing, and

(ii) That person complies with all the terms and conditions of this special permit.

(2) Each facility approved by OHMSAPD to test COPVs under the terms of this special permit must have a resident operator with at least a Level II Certification in MAE.

(3) COPVs requalified under this special permit are only authorized for the service life of the COPV as stated in the relevant special permit.

(4) COPV (tube) handling: If a COPV/tube was removed from the frame during requalification and it was subjected to an impact damage (e.g., drops from a height greater than 2 feet), it must be set aside for additional MAE examination and assessment.

(5) COPVs may not be used for underwater breathing purposes.

(6) A COPV that has been subjected to fire may not be returned to service.

(7) COPVs used in oxygen service or in nitrous oxide service must conform to § 173.302(b)(1) through (3). A COPV that has been subjected to fire may not be returned to service.

(8) Transportation of flammable gases is not authorized aboard passenger-carrying aircraft or cargo vessel.

(9) Transportation of oxygen is only authorized when in accordance with § 175.501.

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(10) COPVs must be packaged in accordance with § 173.301(a)(9) or in accordance with the special permit under which the COPV was manufactured.

8. SPECIAL PROVISIONS:

a. The designated SRT must review the MAE program annually. The designated SRT must submit a letter to OHMSAPD verifying that the MAE program is meeting the terms and requirements of this special permit.

b. The total number of COPVs tested under this special permit must be reported by special permit number and age. These results must be summarized and reported to DOT on an annual basis. A summary of the test results at each facility must be reported (electronic or paper) to the Associate Administrator for Hazardous Materials Safety annually to assess the effectiveness of the test program. The summary must include the total number of COPVs tested under this special permit grouped by type or special permit number, size and age. The summary report must include, cylinder design type, (e.g., UN/ISO 11515), the value of stress factors (F1, F2, M1, and M2) used during final analysis, accept or reject for each COPV, and cause for condemned of a COPV. For any rejected or condemned COPV, the type of defect causing the rejection/condemnation must be fully characterized and profiled (i.e., cuts, abrasions, impacts, fiber failures, chemical damage, heat damage, etc.) and the specific size of the defect should be determined (i.e., length, depth, width, etc.). The COPVs that were condemned at visual inspection (prior to MAE) shall also be included in the report.

c. A statement of qualifications, for each "qualified MAE tester" used under this special permit and information in support thereof, must be maintained by Hexagon Digital Wave LLC. The location of this statement, for each "qualified MAE tester", must be identified to OHMSAPD.

d. A current copy of the DOT special permit for the COPVs listed in this special permit must be maintained at each facility where retesting is performed.

e. Shippers (offerors) may use the COPVs specified and tested in accordance with the provisions of this special permit for the transportation in commerce of those hazardous materials specified herein, provided no modification or

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change is made to the COPVs. All terms of this special permit and other applicable requirements contained in 49 CFR Parts 100-185 must be met.

f. Motor carriers operating under the terms of this special permit must have a "Satisfactory" or "Conditional" safety rating as prescribed in 49 CFR Part 385.

g. Transportation of Division 2.1 (flammable gases) and Division 2.3 (gases which are poisonous by inhalation) materials are not authorized aboard cargo vessel or aircraft unless specifically authorized in the Hazardous Materials Table (§ 172.101).

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, passenger-carrying aircraft, and cargo-only aircraft.
10. MODAL REQUIREMENTS: A current copy of this special permit must be carried aboard each cargo vessel or aircraft used to transport packages covered by this special permit. The shipper must furnish a current copy of this special permit to the air carrier before or at the time the shipment is tendered.
11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this special permit and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:
 - o All terms and conditions prescribed in this special permit and the Hazardous Materials Regulations, 49 CFR Parts 171-180.
 - o Persons operating under the terms of this special permit must comply with the security plan requirement in Subpart I of Part 172 of the HMR, when applicable.
 - o Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this special permit must receive training on the requirements and conditions of this special permit in addition to the training required by §§ 172.700 through 172.704.

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No person may use or apply this special permit, including display of its number, when this special permit has expired or is otherwise no longer in effect.

Under Title VII of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)– “The Hazardous Materials Safety and Security Reauthorization Act of 2005” (Pub. L. 109-59), 119 Stat. 1144 (August 10, 2005), amended the Federal hazardous materials transportation law by changing the term “exemption” to “special permit” and authorizes a special permit to be granted up to two years for new special permits and up to four years for renewals.

12. REPORTING REQUIREMENTS: Shipments or operations conducted under this special permit are subject to the Hazardous Materials Incident Reporting requirements specified in 49 CFR §§ 171.15 Immediate notice of certain hazardous materials incidents, and 171.16 Detailed hazardous materials incident reports. In addition, the grantee(s) of this special permit must notify the Associate Administrator for Hazardous Materials Safety, in writing, of any incident involving a package, shipment or operation conducted under terms of this special permit.

Issued in Washington, D.C.:



for William Schoonover
Associate Administrator for Hazardous Materials Safety

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Pipeline and Hazardous Material Safety Administration, U.S. Department of Transportation, East Building PHH-30, 1200 New Jersey Avenue, Southeast, Washington, D.C. 20590.

Copies of this special permit may be obtained by accessing the Hazardous Materials Safety Homepage at http://hazmat.dot.gov/sp_app/special_permits/spec_perm_index.htm Photo reproductions and legible reductions of this special permit are permitted. Any alteration of this special permit is prohibited.

PO: Mark Toughiry